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River geochemistry: opportunities and challenges

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The thin pellicle at the Earth's surface on which humans live is a "Critical Zone" (CZ). The CZ has long been dissected by different disciplines into a number of compartments, but its integrated behavior, especially in response to the unprecedented current anthropogenic forcing, is still poorly understood. Rivers "average" the CZ over their drainage areas and therefore provide "integrated" information telling a lot about the CZ functions and processes. However, compared to other Earth components such as the atmosphere or the ocean, the geochemical knowledge on rivers and groundwaters is still in a very primitive state, especially regarding measurements of high temporal and spatial resolution.

We will show how the CRITEX program is contributing at improving our ability to chemically monitor rivers by developing new sensors. We will particularly focus on the "River Lab" (RL), a Lab-in-the-field prototype that is measuring major dissolved ions every 30 minutes in the Orgeval CZ Observatory (France). The wealth of data generated by the RL reveals unsuspected patterns of chemical variations at different time scales, providing insight into the underlying processes. The RL facilitates the dialogue between hydrology and geochemistry as water flow and hydrochemistry are recorded at the same frequency. Beyond this example, to face the challenges of the Anthropocene we need a significant breakthough in real-time potamochemistry